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GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
DIRECTORATE GENERAL OF TRAINING

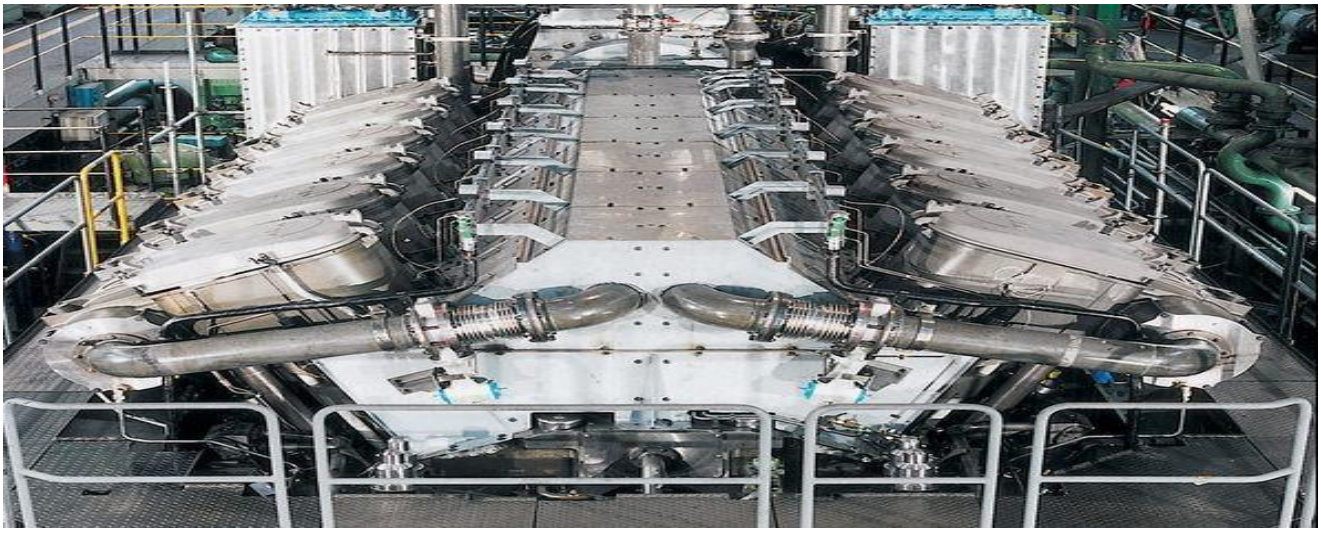
COMPETENCY BASED CURRICULUM

MARINE ENGINE FITTER

(Duration: One Year)
Revised in July 2022

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 3



SECTOR – CAPITAL GOODS AND MANUFACTURING

कौशलं बलम्
Directorate General of Training

MARINE ENGINE FITTER

(Engineering Trade)

(Revised in July 2022)

Version: 2.0

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL - 3

Developed By

Ministry of Skill Development and Entrepreneurship

Directorate General of Training

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1. COURSE INFORMATION

During the one year's duration a candidate of Marine Engine Fitter trade is trained on subjects Professional Skill, Professional Knowledge and Employability Skills related to job role. In addition to this a candidate is entrusted to make/do project work and Extra Curricular Activities to build up confidence. The broad components covered under Professional Skill & Professional Knowledge subjects are as below:

The trainee learns about safety and environment, use of fire extinguishers, comply safe working practice and housekeeping and begin with the basic fitting skills sawing, filing, marking, chipping, drilling are imparted. Procedure to overhaul, run single / multi-cylinder I.C. engines and marine engines. Dismantle engine parts, reassemble and check the functions of valves & valve seats, oil pump, radiator and cooling system.

The trainee will be able to operate, maintain, overhaul and diagnose defects and trouble shooting of marine engine. Erection & installation of engines, starting and checking performance of engine. Overhaul air compressor, fuel feed & fuel injection, lubrication system. Maintenance of battery, overhaul of distributor, starter motor, ignition systems and including simple electrical &electronic circuits.

2. TRAINING SYSTEM

2.1 GENERAL

The Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers a range of vocational training courses catering to the need of different sectors of economy/ Labour market. The vocational training programmes are delivered under the aegis of Directorate General of Training (DGT). Craftsman Training Scheme (CTS) with variants and Apprenticeship Training Scheme (ATS) are two pioneer schemes of DGT for strengthening vocational training.

Marine Engine Fitter trade under CTS is one of the popular courses delivered nationwide through a network of ITIs. The course is of one year duration. It mainly consists of Domain area and Core area. The Domain area (Trade Theory & Practical) imparts professional skills and knowledge, while Core area (Employability Skills) imparts requisite core skill, knowledge and life skills. After passing out of the training programme, the trainee is awarded National Trade Certificate (NTC) by DGT which is recognized worldwide.

Candidates need broadly to demonstrate that they are able to:

- Read & interpret technical parameters/documentation, plan and organize work processes, identify necessary materials and tools;
- Perform task with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
- Apply professional knowledge, core skills & employability skills while performing the job and maintenance work.
- Check the task/job for functioning, identify and rectify errors in task/job.
- Document the technical parameters related to the task undertaken.

2.2 PROGRESSION PATHWAYS:

- Can join industry as Technician and will progress further as Senior Technician, Supervisor and can rise up to the level of Manager.
- Can become Entrepreneur in the related field.
- Can join Apprenticeship programme in different types of industries leading to National Apprenticeship certificate (NAC).
- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.
- Can join Advanced Diploma (Vocational) courses under DGT as applicable.

2.3 COURSE STRUCTURE:

Table below depicts the distribution of training hours across various course elements during a period of one year: -

S No.	Course Element	Notional Training Hours
1	Professional Skill (Trade Practical)	840
2	Professional Knowledge (Trade Theory)	240
3	Employability Skills	120
	Total	**1200**

Every year 150 hours of mandatory OJT (On the Job Training) at nearby industry, wherever not available then group project is mandatory.

4	On the Job Training (OJT)/ Group Project	150

Trainees of one-year or two-year trade can also opt for optional courses of up to 240 hours in each year for 10th/ 12th class certificate along with ITI certification, or, add on short term courses.

2.4 ASSESSMENT & CERTIFICATION

The trainee will be tested for his skill, knowledge and attitude during the period of course through formative assessment and at the end of the training programme through summative assessment as notified by the DGT from time to time.

a) The **Continuous Assessment (Internal)** during the period of training will be done by **Formative assessment method** by testing for assessment criteria listed against learning outcomes. The training institute have to maintain individual *trainee portfolio* as detailed in assessment guideline. The marks of internal assessment will be as per the formative assessment template provided on www.bharatskills.gov.in

b) The final assessment will be in the form of summative assessment. The All India Trade Test for awarding NTC will be conducted by Controller of examinations, DGT as per the guidelines. The pattern and marking structure is being notified by DGT from time to time. **The learning outcome and assessment criteria will be the basis for setting question papers for final assessment. The examiner during final examination will also check** the individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS REGULATION

For the purposes of determining the overall result, weightage of 100% is applied for six months and one year duration courses and 50% weightage is applied to each examination for two years courses. The minimum pass percent for Trade Practical and Formative assessment is 60% & for all other subjects is 33%.

2.4.2 ASSESSMENT GUIDELINE

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking assessment. Due consideration should be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scarp/wastage as per procedure, behavioral attitude, sensitivity to environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising some of the following:

- Job carried out in labs/workshop
- Record book/ daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality
- Assignment
- Project work
- Computer based multiple choice question examination
- Practical Examination

Evidences and records of internal (Formative) assessments are to be preserved until forthcoming examination for audit and verification by examination body. The following marking pattern to be adopted for formative assessment:

Performance Level	Evidence
(a) Marks in the range of 60 -75% to be allotted during assessment	
For performance in this grade, the candidate with occasional guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of an acceptable standard of craftsmanship.	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment • 60-70% accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A fairly good level of neatness and consistency in the finish • Occasional support in completing the project/job.
(b)Marks in the range of above75% - 90% to be allotted during assessment	
For this grade, the candidate, with little guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of a reasonable standard of craftsmanship.	• Good skill levels in the use of hand tools, machine tools and workshop equipment • 70-80% accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A good level of neatness and consistency in the finish • Little support in completing the project/job
(c) Marks in the range of above 90% to be allotted during assessment	
For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.	• High skill levels in the use of hand tools, machine tools and workshop equipment • Above 80% accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

3. JOB ROLE

Brief description of Job roles:

Mechanic, Petrol Engine; Petrol Engine Fitter, locates defects, repairs, and overhauls stationary petrol engines for correct performance to drive pumps, generators, propulsion shafts, etc., checks engine to locate defects. Dismantles or partly dismantles it according to nature of defects and measures essential parts such as cylinder bore, crank pins, pistons etc., using cylinder gauge, micrometer and other appropriate tools. Gets cylinders rebored, valve seats refaced and liners filled if necessary. Fits and taps pistons in cylinders, de-carbonize cylinder head and grinds valves using appropriate abrasives. Replaces or repairs worn out or damaged parts and assembles them, doing supplementary tolling as necessary to ensure accuracy of fit. Installs assembled or repaired engine in position, sets timings, fits accessories, adjusts tappets, carburettor, fan belt etc. and connects it to propulsion drive. Starts engine, tunes it precisely and runs it at prescribed or set standard making necessary adjustments. Observes different readings such as temperature, fuel level, oil pressure etc. for optimum performance. Checks, adjusts and lubricates equipment periodically and performs other operations to keep engine in good working order. May rebore engine, reface valve seats, anneal pipes, braze or solder parts etc.

Assembler, Stationary Diesel Engine; assembles stationary diesel engine from finished components, makes adjustments, sets alignments, clearances etc. and ensures stipulated performance. Places diesel engine block on jig or other fixture using hoisting equipment. Fits or assembles various parts to engine block such as crank shaft, cam shaft, main bearing, connecting rods, timing gears pistons, fuel pump, atomiser, automatic timing mechanism, exhaust manifold suspension, etc. using spanners, wrenches, screw drivers and other special tools and devices. Collects various parts like nuts, bolts, washers etc. from nearby bins and fits or screws them to cylinder head. Checks assembled units or parts at every stage for prescribed accuracy, alignment, tolerance etc. using special tools. Records part number fitted or assembled to engine block and notes factual details or position regarding clearances, adjustments etc. made. Assembles other sub-assemblies like starter, alternator timing chain, heater assembly switch, radiator etc. Places assembled engine at central places for engine test. May conduct engine test on dynamo meter and note actual tuning conditions and make necessary adjustments. May overhaul and repair engines or other components.

Plan and organize assigned work and detect & resolve issues during execution in his own work area within defined limit. Demonstrate possible solutions and agree tasks within the team. Communicate with required clarity and understand technical English. Sensitive to environment, self-learning and productivity.

Reference NCO-2015:

a) 7233.0300 - Mechanic, Petrol Engine
b) 8211.0600 - Assembler, Stationary Diesel Engine

Reference NOS:

(I) ISC/N9401,

(II) ISC/N 9402

(III) ISC/N 9422

(IV) ISC/N 9424

(V) ISC/N 9426

(VI) ISC/N 9429

(VII) ISC/N 9445

(VIII) ISC/N 9446

(IX) ISC/N 9447

(X) ISC/N 9448

(XI) ISC/N 9449

(XII) ISC/N 9450,

4. GENERAL INFORMATION

Name of the Trade	**MARINE ENGINE FITTER**
Trade Code	**DGT/1086**
NCO - 2015	7233.0300, 8211.0600
NOS covered	ISC/N9401, ISC/N 9402, ISC/N 9422, ISC/N 9424, ISC/N 9426, ISC/N 9429, ISC/N 9445, ISC/N 9446, ISC/N 9447, ISC/N 9448, ISC/N 9449, ISC/N 9450,
NSQF Level	Level – 3
Duration of Craftsmen Training	One Years (1200 hours + 150 hours OJT/Group Project)
Entry Qualification	Passed 10th class examination with Science and Mathematics or with vocational subject in same sector or its equivalent.
Minimum Age	14 years as on first day of academic session.
Eligibility for PwD	LD, LC, DW, AA, LV, DEAF
Unit Strength (No. Of Student)	20 (There is no separate provision of supernumerary seats)
Space Norms	105 Sq. m
Power Norms	3 KW
Instructors Qualification for	

(i) Marine Engine Fitter Trade	B.Voc/Degree in Marine / Mechanical Engineering from AICTE/UGC recognized Engg. College/university with one year experience in the relevant field **OR** 03 years Diploma in Marine / Mechanical Engineering from AICTE/ recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years experience in the relevant field **OR** NTC/NAC passed in the Trade of "Marine Engine Fitter" With three years' experience in the relevant field. **Essential Qualification:** Relevant Regular / RPL variants of National Craft Instructor Certificate (NCIC) under DGT. ***Note: - Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications. However, both of them must possess NCIC in any of its variants.***
(ii) Workshop Calculation & Science	B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field. **OR** 03 years Diploma in Engineering from AICTE / recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field. **OR** NTC/ NAC in any one of the engineering trades with three years' experience. **Essential Qualification:** Regular / RPL variants of National Craft Instructor Certificate (NCIC) in relevant trade **OR** Regular / RPL variants NCIC in RoDA or any of its variants under DGT

(iii) Engineering Drawing	B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field. **OR** 03 years Diploma in Engineering from AICTE / recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field. **OR** NTC/ NAC in any one of the Mechanical group (Gr-I) trades categorized under Engg. Drawing'/ D'man Mechanical / D'man Civil' with three years' experience. **Essential Qualification:** Regular / RPL variants of National Craft Instructor Certificate (NCIC) in relevant trade **OR** Regular / RPL variants of NCIC in RoDA / D'man (Mech /civil) or any of its variants under DGT.
(iv) Employability Skill	MBA/ BBA / Any Graduate/ Diploma in any discipline with Two years' experience with **short term ToT Course in** Employability Skills. (Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above) **OR** **Existing Social Studies Instructors in ITIs with short term ToT Course in** Employability Skills.
(v) Minimum Age for Instructor	21 Years
List of Tools and Equipment	As per Annexure – I

5. LEARNING OUTCOME

Learning outcomes are a reflection of total competencies of a trainee and assessment will be carried out as per the assessment criteria.

5.1. LEARNING OUTCOMES

1. Plan and organize the work to make jab as per specification applying different types of basic fitting operation and check for dimensional accuracy following safety precautions. [Basic fitting operation: marking, hack sawing, chipping, filing, drilling, Tapping] following safety precautions. (NOS:ISC/N9422)
2. Demonstrate different joining operations observing standard procedure. [Different joints – bolt joints, riveting, gas welding arc welding, brazing, lock nut, cotter split pin etc.] (NOS:ISC/N9424)
3. Perform dismantling & assembling of multi-cylinder marine engine as per Makers' manual and check functionality. (NOS:ISC/N9426)
4. Overhaul Oil pump, Filters, Radiator, Cooling system and check functionality. (NOS:ISC/N9445
5. Overhaul air compressor, turbo charger and perform Gas charging &leak Testing of engine refrigeration. (NOS:ISC/N9446
6. Check the cooling & lubrication system and conduct necessary maintenance as per requirement (NOS:ISC/N9429)
7. Diagnosis engine faults Erect& Install Engines and ensure functionality. (NOS:ISC/N9447
8. Repair & maintain Fuel feed systems, fuel Injection pump. (NOS:ISC/N9448
9. Maintain shop floor tools &Equipments as per standard procedure. (NOS:ISC/N9449
10. Measure and test Electrical / Electronic circuits/ components and check performance. (NOS:ISC/N9450
11. Read and apply engineering drawing for different application in the field of work. (NOS:ISC/N9401
12. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS:ISC/N9402

6. ASSESSMENT CRITERIA

LEARNING OUTCOMES	ASSESSMENT CRITERIA
1. Plan and organize the work to make jab as per specification applying different types of basic fitting operation and check for dimensional accuracy following safety precautions. [Basic fitting operation: marking, hack sawing, chipping, filing, drilling, Tapping] following safety precautions. (NOS:ISC/N9422)	Observe safety procedure during all the operations as per the standard norms and guidelines.
	Plan the various operations involved, identify the tools and instruments and make this available in time.
	Obtain suitable raw material free from defects.
	Mark the dimensions on the job with marking tools as per standards.
	Carryout the operations like hack sawing, chipping, filing etc as per the specification.
	Inspect the finished job as per the standard procedure and to ensure dimensions are within prescribed limit.
2. Demonstrate different joining operations observing standard procedure. [Different joints – bolt joints, riveting, gas welding arc welding, brazing, lock nut, cotter split pin etc.] (NOS:ISC/N9424)	Plan and select appropriate tools and materials for timely use.
	Set the equipment observing safety
	Perform joining as per requirement
	Check the joint for conforming standard procedure of standard requirement
	Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
3. Perform dismantling & assembling of multi-cylinder marine engine as per Makers' manual and check functionality. (NOS:ISC/N9426)	Plan & select appropriate tools equipment for the work and make it available timely.
	Dismantle the different components of multi cylinder marine engine.
	Check for any defects/correctness & measure dimensions of the components using appropriate instruments.
	Demonstrate possible solutions within the team using desired mathematical skills, knowledge of facts, principles, processes and general concept in the field of work.
	Solve problems during operation by selecting and applying basic

	methods, tools, materials and collect and organize information for quality output
	Assemble components & check functionality of engine.
4. Overhaul Oil pump, Filters, Radiator, Cooling system and check functionality. (NOS:ISC/N9445	Understand the procedure of the dismantling, servicing and assembling of the oil Pumps.
	Check the dismantled pumps and its parts and assemble the pumps in systematic order.
	Check filters during cleaning and re-assembly and precautions to be taken while working
	Identify Radiator, cooling system of Marine engine
	Check water pump refitting, adjustment of fan belt tension and connection of water pump with radiator hoses & flushing cooling system of the engine
5. Overhaul air compressor, turbo charger and perform Gas charging & leak Testing of engine refrigeration. (NOS:ISC/N9446	Demonstrate risks involved in working with compressed air for auxiliary purposes.
	Overhaul Air compressor & Turbo charger
	Check & measure components by using appropriate instruments
	Charge gas to Refrigeration plants and check the performance
	Perform leak testing and maintenance of compressor and connected equipment
6. Check the cooling & lubrication system and conduct necessary maintenance as per requirement. (NOS:ISC/N9429)	Identify various parts of cooling and lubrication system and their functions.
	Plan & select appropriate tools to carry out the work
	Remove the parts of cooling & lubrication system and perform required maintenance as per standard procedure.
	Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
	Observe safety/ precaution during the work.
	Test the cooling & lubrication system to check functionality
7. Diagnosis engine faults Erect & Install Engines and ensure	Plan & Collect relevant information to perform trouble shooting of Engine

functionality. (NOS:ISC/N9447	Diagnose the various defect & fault of engine
	Practice in erecting overhauled engines on stands & foundation
	Starting engine on foundation and observing for permissible vibrations
8. Repair & maintain Fuel feed systems, fuel Injection pump (NOS:ISC/N9448	Select appropriate tools & equipment and make use of them timely manner
	Dismantle fuel injector & feed pump
	Assemble and adjust the feed pump & Injector
	Test fuel feed system performance.
	Check the fuel injection pump performance as per set procedure
9. Maintain shop floor tools &Equipments as per standard procedure. (NOS:ISC/N9449	Collect relevant information related to shop floor equipment performance.
	Prepare Maintenance schedule to check daily, weekly, monthly for different Engines & Auxiliary Machines.
	Record the shop floor equipment on their utilization and maintenance.
10. Measure and test Electrical / Electronic circuits/ components and check performance. (NOS:ISC/N9450	Study of AC & DC Current
	Identify the Basic Electrical & Electronic Parts
	Test for the simple circuits
	Check the performance as set procedure
11. Read and apply engineering drawing for different application in the field of work. (NOS:ISC/N9401	Read & interpret the information on drawings and apply in executing practical work.
	Read &analyze the specification to ascertain the material requirement, tools and assembly/maintenance parameters.
	Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
12. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and	Solve different mathematical problems
	Explain concept of basic science related to the field of study

explain basic science in the field of study. (NOS:ISC/N9402	

SYLLABUS FOR MARINE ENGINE FITTER TRADE			
DURATION: ONE YEAR			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Professional Skill 125 Hrs; Professional Knowledge 25 Hrs	Plan and organize the work to make jab as per specification applying different types of basic fitting operation and check for dimensional accuracy following safety precautions. [Basic fitting operation: marking, hack sawing, chipping, filing, drilling, Tapping] following safety precautions. (NOS:ISC/N9422)	1. Familiarization with the institutes. (05 hrs.) 2. Importance of the trade machinery used in the trade - types of work done by students in the institute shop of the institute. (15 hrs.)	General introduction to the course-duration of the course and course content. Study of the syllabus general rules pertaining to the institute facilities- library working hours. Occupational Safety & Health Basic safety introduction, Personal protection:- Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. Use of Fire extinguishers. Visit & observation of sections. (04 Hrs)
		3. Description of safety equipment their use – safety rules to be observed in the repair shop. (05 hrs.) 4. Accidents their causes. Fire extinguishers uses. (05 hrs.) 5. Familiarization of the tools, machinery available in the repair shop. (04 hrs.) 6. Their use and up keep importance of maintenance, cleanliness of workshop. Tools, jacks trays and hoses. (04 hrs.)	Importance – Safety or general precautions to be observed in the shop floor. Types of fire, class of fire, fire extinguishers used for different types and class of fire, storing and handling of inflammable materials- Elementary First Aid. Study of personal protective equipments used in Marine plant. Environmental pollution, sources, causes, consequences and controls. (04 Hrs)
		7. Demonstration of the use of Fitter's Hand Tools, marking off with steel rules,	Systems of measurement conversion of English into metric measurement and vice versa –

			calipers, scriber, dividers, dot & center punch, chipping in marked lines in a given piece, sharpening of chisels, center punch and dot punches to a correct angles. (20 hrs.)	marking media -. Chalk, Prussian Blue, Red lead and Tools used for marking e.g., steel rule, Try Square, etc. (04 Hrs)
			8. Hack sawing filling to given dimensions - filling true and square practice different types of filling operation - making and drilling clear and blind holes. (12 hrs.) 9. Sharpening of twist drill, safety precautions to be observed while using a drilling machine. (10 hrs.)	Types of hacksaw frames and blades - their selection and uses. Types of files and their uses. Care and maintenance of files. Types and sizes of drills - cutting angles and speeds of drills, calculation of tap drill sizes. (04 Hrs)
			10. Tapping a clear and blind hole. selection of tap drill sizes. (09 hrs.) 11. Use of lubrication cutting threads on a bolt/ stud adjustment of two piece die reaming a hole/bush to suit the given pin/shaft scraping a given mechanical surface. (14 hrs.)	Taps & dies description use of different types of taps and dies - use of 'V' threads precautions while using taps and dies - description and use of different types of scrapers, reamers and emery papers. (04 Hrs)
			12. Correct measurement techniques of micrometer, vernier caliper, vernier bevel protector. (08 hrs.) 13. Measuring diameter of pistons, main journals, crank pins, king pin big end, main bearings, cylinder bores using micrometer and vernier calipers. (08 hrs.) 14. Measuring of thickness, machined flat surface, bars	Study of construction of micrometer (outside & inside) and vernier caliper, vernier bevel protector. Calculation of least count for micrometer, venier caliper and vernier bevel protector. Calculation of errors & correct dimension for Micrometer. Use and care of measuring instruments. Use of combination sets. (05 Hrs)

		valve angles, head locating centers of a round bar with center head. (06 hrs.)	
Professional Skill 60 Hrs; Professional Knowledge 12 Hrs	Demonstrate different joining operations observing standard procedure. [Different joints – bolt joints, riveting, gas welding arc welding, brazing, lock nut, cotter split pin etc.] (NOS:ISC/N9424)	15. Simple marking of sheet metal and cutting. (03 hrs.) 16. Joining of sheet metal, parts by soft soldering, bending and folding. (03 hrs.) 17. Practice in silver soldering. (06 hrs.) 18. Practice in soldering, brazing, annealing, bending of pipes. Practice for nipples, union & other pipe joint. (12 hrs.) 19. Exercise involving use of wrenches, pliers, screw drivers, and pliers -cleaning and lubrication of engine parts, location and identification of engine components. (12 hrs.) 20. Practice on unserviceable diesel engine, removing jammed nuts and broken studs reconditioning and damaged stud hole fitting over sized stud. (12 hrs.) 21. Selection of materials for gaskets and packing - use of locking devices lock nuts, cotters, split pin, circlips, lock rings (08 hrs.) 22. Location where they are used inspection and checking leakage of air, fuel oil and exhaust in the engine. (04 hrs.)	Study of sheet metal workers hand tools their description and uses. Use of sheet and wire gauges. Description of simple soldering & brazing, Use of fluxes for common joints - types of sheet metal joints - their uses. Study of blow lamp and its uses. Difference between pipe & tubes. Types of pipe fitting (in marine) its purposes. Study about connecting two pipe pieces, branching, changing in diameter, direction & stopping the end of pipes. General description and construction of diesel engine - characteristics and classification working principles of 4 strokes cycle diesel and petrol engine. Comparisons between petrol and diesel engine. Two stroke cycle diesel engine types of scavenging uniflowand loop flow scavenge opposed copper piston engine differences between two stroke and four stroke cycle diesel engines. Engine details - cylinder materials -cylinder liners and their advantages, cylinder heads, description function, cares and maintenance - location combustion chamber in cylinder heads and also heater plugs and port and valve arrangements. (12 Hrs)

Professional Skill 230 Hrs; Professional Knowledge 44 Hrs	Perform dismantling & assembling of multi-cylinder marine engine as per Makers' manual and check functionality. (NOS:ISC/N9426)	23. Practice on starting and stopping of diesel engines. (07 hrs.) 24. Use of speed counter in determining the engine speed /rpm of the engine. (07 hrs.) 25. Checking of temperature and pressure of oil and cooling water, exhaust gas temperature etc. (08 hrs.)	Combustion chambers - open and closed types, advantages and disadvantages compression ratio & compression pressures, compression testing of cylinders and analysis of results & its importance. (05 Hrs)
		26. Maintenance schedule to check -daily, weekly, monthly for different types of engines. (08 hrs.) 27. Writing procedure of inspection schedules - maintenance log book - details of maintenance work (12 hrs.)	Need of maintenance, check up in IC engines - preparation of maintenance schedule from charts of popular makes of engine. (04 Hrs)
		28. Remove rocker arm assy. (04 hrs.) 29. Manifolds, and cylinder head - removing valves and its parts - cleaning and decarburizing - checking valve seat and valve guide - reconditioning valve seats and refacing valves -lapping valves on its seat - testing leakage of valve seat for leakage. (09 hrs.) 30. Inspection of cylinder head and manifold surfaces for lapping and cracks. (09 hrs.)	Engine Valves & valves operation -mechanism - parts and function of each valve timing diagram, cam shaft and timing, gears - types of drives used in engines, chain tension and its importance, cylinder head and manifold construction and its function - water jackets passages. (05 Hrs)
		31. Dismantle of rocker arm assembly -clean and check shaft - bushes, pork and rocker arm for wear and cracks and reassemble. (07 hrs.)	Description and function of valve parts -maintenance material used - necessity of valve clearance prescribed by makers of engine - effect of incorrect clearance -common trouble and

		32. Check valve springs, tappets push rods, tappet screws, and valve stem cap. (08 hrs.) 33. Reassembling of valve parts in sequence refit cylinder head and manifold, rocker arm assy., adjusting of valve clearances, starting of engine after decarburizing. (07 hrs.)	remedies reason for lapping of cylinder head. (05 Hrs)
		34. Removing piston & connecting rod from engine - examine - piston ring grooves for wear - examine piston for cracks & distortions, clean oil holes. (07 hrs.) 35. Measuring piston ring clearances- check connecting rod for bend and twist and cylinder bore for taper and ovality and gudgeon pin bushes for wear. (07 hrs.) 36. Check elongation of BE bearing bolts. (08 hrs.)	Piston and piston rings - function - types and material used recommended clearances for the rings and its necessity - precautions while fitting rings. Connecting rod – types function and material used - methods of fixing gudgeon pin on small end method of lubrication provided for small end bushes.(05 Hrs)
		37. Removing crank shaft and cam shaft from engine - checking crank shaft for bend & twist. (03 hrs.) 38. Checking oil retainer and thrust surfaces for wear. (02 hrs.) 39. Measure crank shaft journal for wear. (02 hrs.) 40. Checking flywheel and mounting flange - spigot, bearing. (03 hrs.) 41. Check vibration damper for defects. (03 hrs.)	Crank shaft - construction and function material used - arrangements of crank pins and main journal - balancing method -flywheel - construction and its function and material used. Elementary knowledge of function of clutch and coupling units attached to flywheel. (05 Hrs)

		42. Check cam shaft for bend and crack. (02 hrs.) 43. Check crank shaft deflection. (03 hrs.)	
		44. Checking cylinder blocks surface -major cylinder bore for tapered and ovality. (03 hrs.) 45. Check main bearing for tape and ovality, clean oil gallery passage and oil pipe lines. (03 hrs.) 46. Check main bearing cap bolt holes. (04 hrs.) 47. Check cam shaft bearing and tappet bolts. (02 hrs.) 48. Descaling water passage and examine bursting disc. (02 hrs.) 49. Check cylinder head for warping. (05 hrs.)	Description and function of cylinder block - material used for - cylinder & liners, effect of sea water with engine body, cylinder & liners. Construction of water jacket passage and wall thickness. Fixing of cylinder head and mountings. Fixing of accessories like oil pump, water pump, filters - oil flow passages and cleaning plugs. (05 Hrs)
		50. Fixing of crank shaft and bearing and engine entablature. (10 hrs.) 51. Checking and adjusting of clearances end play etc. (10 hrs.)	Engine bearing - classification and location - material used. Composition of bearing materials - shell bearing and their advantages - special bearing material for diesel engine application bearing failure and its causes - care and maintenance. (07 Hrs)
		52. Reassemble all parts of engine in correct sequence and torque all bolts and nuts as per makers recommendations for engines. (20 hrs.)	Need for lubrication system for diesel engines – types used and layout of the system by pass & full flow arrangement – types of oil pumps, oil filters, oil coolers, common troubles – care and maintenance. (05 Hrs)

		53. Reassemble all parts of engine in correct sequence and torque all bolts and nuts as per makers' recommendations for engines. (15 hrs.) 54. Fit accessories & start and run the engine on stands. (06 hrs.)	Engine assembly procedure need for cleanliness and special tools and gauges used for engine assembling, practice – periods of decarburizing and overhauling engine in terms of hours of run or mileage – running in procedure of overhauled engines. (04 Hrs)
		55. Removing cylinder liners from cylinder block. (09 hrs.) 56. Practice in measuring and refitting new liners as per maker's recommendations. (08 hrs.) 57. Precautions while fitting new liners. (05 hrs.)	Cylinder liners – construction & purpose –material used and finish provided types of liners in use – methods used to fit the samein cylinder bore, advantages of wet and dry liners wear, pattern & allowable wear, cylinder wear and its causes. (04 Hrs)
Professional Skill 45 Hrs; Professional Knowledge 10 Hrs	Overhaul Oil pump, Filters, Radiator, Cooling system and check functionality. (NOS:ISC/N9445	58. Overhauling of oil pump, oil filters, oil coolers, air cleaners and air filters. (08 hrs.) 59. Adjusting of oil pressure relief valves. (07 hrs.) 60. Changing oil in the sump repairs to oil flow pipe lin and unions. (08 hrs.)	Friction - its meaning and importance methods to reduce friction in engines - use of lubricants - oil grease high detergent oil for diesel engine lubricants.(05 Hrs)
		61. Removing radiator and water pump from engine, cleaning & reverse flushing. (08 hrs.) 62. Radiator testing thermostat and refitting on engine. (05 hrs.) 63. Overhauling – water pump refitting – adjusting fan belt tension and connecting water pump with radiator with hoses & flushing cooling system of the engine. (09 hrs.)	Need for cooling an engine general description & types of air and water –cooling used in engine – layout of cooling system and function of parts like radiator –thermostat & need to maintain engine working temperature. Effect of sea water in marine engine cooling system. Prevention of corrosion of engine parts from sea water. (05 Hrs)

Professional Skill 45 Hrs; Professional Knowledge 10 Hrs	Overhaul air compressor, turbo charger and perform Gas charging & leak Testing of engine refrigeration. (NOS:ISC/N9446	64. Dismantling air compressor and turbo chargers. (07 hrs.) 65. Cleaning all parts - measuring wear - reassembling all parts and fitting them in the engine. (08 hrs.) 66. Dismantling different types of pumps, checking and reassembling. (08 hrs.)	Description & operation of Air compressor, turbo chargers and common troubles & maintenance. Description of different types of pumps (centrifugal, reciprocating, gear, screw, etc.)(05 Hrs)
		67. Basic procedure for gas charging, leak testing and general maintenance of marine engine refrigeration. (13 hrs.) 68. Recommended procedure for application of paints to ship/vessel. (09 hrs.)	Basic refrigeration system in marine -operation and maintenance. Marine paints its specialty, types, Indian standards, recommended paints for inside and outside of ships/vessel. Anti-fouling, leaching, pigment operation for paints. (05 Hrs)
Professional Skill 25 Hrs; Professional Knowledge 07 Hrs	Check the cooling & lubrication system and conduct necessary maintenance as per requirement (NOS:ISC/N9429)	69. Troubleshooting in cooling and lubrication system/engine checking up and correcting oil and water leaks. (15 hrs.) 70. Changing defective packing and gaskets -testing functioning of thermostat. (10 hrs.)	Step by Step method of diagnosis of troubles in the lubrication and cooling system, reasons for engine overheating & remedies for the same. Crank case contamination and crank case ventilation, flow test rate recommended for radiator. (07 Hrs)
Professional Skill145 Hrs; Professional Knowledge 28 Hrs	Diagnosis engine faults Erect & Install Engines and ensure functionality. (NOS:ISC/N9447	71. Diagnosis of engine faults like main bearing - noises piston pin noise flywheel knock & valve noise and crank noises and diesel knock. (08 hrs.) 72. Diagnosis of engine faults like smoky, exhaust, overheating, heavy vibration, missing cylinders, exhaust noise, hunting characteristics of engine	Reasons for excessive exhaust smoke overheating, vibration missing & hunting noises and its reasons for development of noises in engine, methods of rectification for noises for smooth working of the engine. Engine assembling practice for overhauling of engine - procedure, observations, precautions, alignments between spare parts, makers

		and erratic or irregular idling. (07 hrs.) 73. Diagnosis of reasons for starting difficulty in a diesel engine and rectifying the faults. (06 hrs.)	recommendation for setting of spare parts. Starting methods used for starting diesel engines used for marine, brief description of each method - methods to eliminate starting difficulty in a diesel engine. (05 Hrs)
		74. Practice in erecting overhauled engines on stands & foundations. (05 hrs.) 75. Preparation of templates of foundation holes of the engine base. (06 hrs.) 76. Preparation of holding down bolts and nuts and boxes for foundation. (06 hrs.) 77. Starting engine on foundation and observing vibrations. (04 hrs.)	Foundations for diesel engine in marine-details of foundation bolts & nuts its dimensions. Boxes to suit engine base - purpose of template need for aligning the engine on HD Bolts. Checking methods for alignment. (04 Hrs)
		78. Start engine adjust idling speed and damping device in pneumatic governor and venture control unit. (07 hrs.) 79. Checking performance of engine with off load adjusting timings. (12 hrs.)	Power transmission system - types, belt pulley, chain, gear, coupling etc. Governors- pneumatic type- construction & operation - venturi unit and its purpose and action - precaution to be observed in attending to the governor- definition of rated speed - maximum speed -over run of governors- purpose of auxiliary venturi in the Governor - principle of idling damper. (08 Hrs)
		80. Start engine-adjusting idle speed of the engine fitted with mechanical and hydraulic governors. (12 hrs.) 81. Checking-high speed	Mechanical governors, Their construction, function and operation under different load and speed and maintenance - common troubles and remedies including hydraulic governors.

		operation of the engine. (07 hrs.)	(02 Hrs)
		82. Checking performance for missing cylinder by isolating defective injectors. – (16 Hrs.) 83. Dismantle and replace defective parts and reassemble and tefit back to the engine. (12 hrs.) 84. Importance of correct setting of pressure - while assembling the unit and also fitting on to the engine. (12 hrs.)	Fuel injection Nozzles description and operation of each type spray angles and orifices and their characteristic-injector Tester- construction and function types of tests and their purpose. Effects of incorrect setting of nozzles on engine performance. (08 Hrs)
Professional Skill 60 Hrs; Professional Knowledge 12 Hrs	Repair & maintain Fuel feed systems, fuel Injection pump. (NOS:ISC/N9448	85. Cleaning fuel tanks, checking leaks in the fuel lines. (06 hrs.) 86. Soldering & repairing pipe lines and unions brazing nipples to high pressure line studying the fuel feed system in diesel engines draining of water separators (centrifuges).- (12 hrs.) 87. Bleeding of air from the fuel lines servicing primary & secondary filters removing filters elements in pressure filters, overhauling of fuel valves. (12 hrs.) 88. Dismantling an unserviceable fuel injection pump. (07 hrs.) 89. Feed pump governor studying the parts and reassemble general	Fuel feed system in diesels - Air injection and airless injection systems their general description and layout importance of water separators, constructional details of water separators (centrifuges). Fuel filters types & constructional details - reasons for using no. of filters sequence of replacement of filter elements -Importance of diesel fuel cleanliness - types of diesel fuel HSD & HFO - Description of oil fuel valves & their functions Constructional details of fuel injection pumps, feed pumps and governors -explanation of function and operation. Importance of fuel valve and pump timing and method of advancing and retarding and its

		maintenance of fuel injection Pumps. (10 hrs.) 90. Removing a fuel injection pump from an engine. (05 hrs.) 91. Refits the pump to the engine reset timing -fill adjust slow speed of the engine. (08 hrs.)	effects on the firing. (12 Hrs)
Professional Skill 45 Hrs; Professional Knowledge 10 Hrs	Maintain shop floor tools &Equipments as per standard procedure. (NOS:ISC/N9449	92. Repairing of grease guns oil cans-oil spray gun & other shop floor equipment. (09 hrs.) 93. Maintenance of drill press, pedestal grinder, valve reface and air compressor.- (14 hrs.)	Importance of periodical maintenance and upkeep of shop equipments. Preventive maintenance to avoid sudden and major failure. preparing maintenance charts for machineries and follow up. (06 Hrs)
		94. Repairing of injector tester, hoses, jacks and stands vacuum & compression gauges. (13 hrs.) 95. Maintenance of washing pumps, hydraulic presses phasing and calibrating machine. – (09 hrs.)	Safe working practice while using work shop tools. (06 Hrs)
Professional Skill 60 Hrs; Professional Knowledge 12 Hrs	Measure and test Electrical / Electronic circuits/ components and check performance. (NOS:ISC/N9450	96. Practice in joining wires & soldering – (04 Hrs.) 97. Forming simple electrical circuits. (03 hrs.) 98. Measuring of current, voltage and resistance. (03 hrs.) 99. Cleaning and topping up of a lead acid battery (03 hrs.) 100. Testing battery with hydrometer, cell tester connecting battery to charger. (07 hrs.)	BASIC ELECTRICAL WORK Simple electrical circuit series & parallel circuits - identification of alternating current and direct current meters -insulators and conductors - types of resistance - ohm's law and its application - common electrical terms and symbols-primary and secondary cells-lead acid battery description - construction - common troubles and remedy . Safe working practice while working on electrical systems. (05 Hrs)
		101. Studying electrical circuits	Description of electrical circuits -

		in the engine assemble checking loose, open and short circuit in ignition circuits. (03 hrs.) 102. Cleaning and testing spark plugs. (05 hrs.) 103. Overhauling of distributor assemble (06 hrs.) 104. Checking and setting ignition timing. (06 hrs.)	ignition system and the components- purpose of induction coil, condenser, spark plugs-common troubles in ignition circuit and its remedy. (03 Hrs)
		105. Removing dynamo from engine, dismantling, cleaning checking for defects, assembling and testing for monitoring action of dynamo & fitting to engine. (08 hrs.) 106. Removing starter motor from the engine. (06 hrs.) 107. Overhauling the starter motor and testing of starter motor. (06 hrs.)	Description of charging circuit-operation of dynamo and regulator Unit- Ignition warning lamp-troubles & remedy in charging system. Description of starter motor circuit-constructional detail of starter motor, solenoid switches, common troubles and remedy in starter circuit. (04 Hrs)
ENGINEERING DRAWING (40 Hrs.)			
Professional Knowledge ED- 40 Hrs.	Read and apply engineering drawing for different application in the field of work. (NOS:ISC/N9401	Introduction to Engineering Drawing and Drawing Instruments – • Conventions • Sizes and layout of drawing sheets • Title Block, its position and content • Drawing Instrument Lines- Types and applications in drawing Free hand drawing of – • Geometrical figures and blocks with dimension • Transferring measurement from the given object to the free hand sketches. • Free hand drawing of hand tools and measuring tools. Drawing of Geometrical figures: • Angle, Triangle, Circle, Rectangle, Square, Rhombus, Parallelogram. • Lettering & Numbering – Single Stroke.	

		Dimensioning • Types of arrowhead • Leader line with text • Position of dimensioning (Unidirectional, Aligned) Symbolic representation – • Different symbols used in the Marine Engine Fitter trade. • Concept and reading of Drawing in • Concept of axes plane and quadrant • Concept of Orthographic and Isometric projections • Method of first angle and third angle projections (definition and difference) Reading of Job drawing related to Marine Engine Fitter trade.
WORKSHOP CALCULATION & SCIENCE (30 Hrs.)		
Professional Knowledge WCS- 30 Hrs.	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS:ISC/N9402	**Unit, Fractions** Classification of unit system Fundamental and Derived units F.P.S, C.G.S, M.K.S and SI units Measurement units and conversion Factors, HCF, LCM and problems Fractions - Addition, substraction, multiplication & division Decimal fractions - Addition, subtraction, multiplication & division Solving problems by using calculator **Square root, Ratio and Proportions, Percentage** Square and square root Simple problems using calculator Applications of Pythagoras theorem and related problems Ratio and proportion Ratio and proportion - Direct and indirect proportions Percentage Percentage - Changing percentage to decimal and fraction **Material Science** Types metals, types of ferrous and non ferrous metals Physical and mechanical properties of metals Introduction of iron and cast iron Difference between iron & steel, alloy steel and carbon steel Properties and uses of rubber, -and insulating materials **Mass, Weight, Volume and Density** Mass, volume, density, weight and specific gravity, numericals realted to sections L,C O. Related problems for mass, volume, density, weight and specific gravity

		Heat & Temperature and Pressure Concept of heat and temperature, effects of heat, difference between heat and temperature, boiling point & melting point of different metals and non-metals Heat &Temperature -Transmission of heat - Conduction, convection and radiation Co-efficient of linear expansion and related problems with assignments Problem of heat loss and heat gain with assignments Thermal conductivity and insulators Concept of pressure - Units of pressure, gauge pressure and gauges used for measuring pressure **Basic Electricity** Introduction and uses of electricity, electric current AC,DC their comparison, voltage, resistance and their units **Trigonometry** Measurement of angles Trigonometrical ratios Trigonometrical tables
Project work / Industrial visit **Broad Areas:** a) Inbound and outbound process management in warehouse. b) Generating reports using MIS systems c) Good practices associated with reporting activities and their benefits. d) Use of Material Handling Equipments in different in-plant setups, their technical and practical limitations, etc.		

SYLLABUS FOR CORE SKILLS
1. Employability Skills (Common for all CTS trades) (120 Hrs)

Learning outcomes, assessment criteria, syllabus and Tool List of Core Skills subjects which is common for a group of trades, provided separately in www.bharatskills.gov.in / dgt.gov.in

ANNEXURE-I

MARINE ENGINE FITTER			
MARINE ENGINE FITTER (For batch of 20 candidates)			
A. TRAINEES TOOL KIT			
S No.	**Name of the Tool &Equipment**	**Specification**	**Quantity**
1.	Hammer Ball peen	0.75 Kg	21(20+1)Nos.
2.	Chisel cold flat	19 mm X 200 mm	21(20+1) Nos.
3.	Steel rule	15 cm (English and Metric)	21(20+1) Nos.
4.	Screw driver	15 cm	21(20+1) Nos.
5.	Screw driver	30 cm 9mm Blade	21(20+1) Nos.
6.	Screw driver	20 cm 9mm Blade	21(20+1) Nos.
7.	Spanner D.E.	set of 12 metric 8-32 mm	21(20+1) Nos.
8.	Pliers combination	15 cm	21(20+1) Nos.
9.	Centre Punch		21(20+1) Nos.
10.	Hand File Flat	200 mm (Second Cut)	21(20+1) Nos.
11.	Ring spanner	set of 12 metric 8-32 mm	21(20+1) Nos.
12.	Steel tool box with locks and keys		21(20+1) Nos.
13.	Safety goggles		21(20+1) Nos.
14.	Safety Helmets		21(20+1) Nos.
15.	Hand Gloves (Leather)		21(20+1) Nos.
B. INSTRUMENTS AND GENERAL SHOP OUTFIT			
TOOLS & EQUIPMENT			
16.	Rule Steel	30cm	2 Nos.
17.	Dividers Spring	15 cm	2 Nos.
18.	Prick Punch	15 cm	5 Nos.

19.	Chisel cross cut	9x3 mm	5 Nos
20.	Hammer ball Peen	0.5 Kg	5 Nos.
21.	Hammer copper	1 Kg with blade	2 Nos.
22.	Engineer square	15 cm blade	5 Nos.
23.	Scriber	15 cm	5 Nos.
24.	Scriber block universal		1 No.
25.	Marking out tables	90 cm x 60 cm x 90 cm (high)	1 No.
26.	Surface plate	60 x 60 cm blade	1 No.
27.	Angle Plate		1 No.
28.	Hacksaw frame		5 Nos.
29.	V - block	75 x 38 mm pair with clamps	2 Nos.
30.	Punch hollow	set of 6	2 sets
31.	Number Punch	set 3 mm	1 set
32.	Letter Punch	set 3 mm	1 set
33.	Hand vice	150 mm	2 Nos.
34.	Screw driver, Electrician	type 20cm size	2 Nos.
35.	File, flat	35cm bustard	2 Nos.
36.	File, flat	25 cm second cut	2 Nos.
37.	File flat	20 cm smooth	2 Nos.
38.	File flat safe edge	25 cm smooth	2 Nos.
39.	File, triangular	15 cm second cut	2 Nos.
40.	File, half round	40 cm second cut	2 Nos.
41.	File round	30 cm, Second cut	2 Nos.
42.	File square	20 cm second cut	2 Nos.
43.	Screw Pitch Gauge (BSW,BSP,BSF and Metric)		1 Set Each

44.	Drill, Twist,	metric 3mm to 12mm by 1mm parallel shank	1 set
45.	Taps and Dies complete	set in box B.A. ,B.S.W. ,BSF American and metric	1 set
46.	H.S.S Hand reamer,	adjustable 10.5 mm to 11.25 mm 11.25 mm to 12.75 mm 12.78mm to 14.25 mm and 14.25 to 15.75mm	1 set
47.	Scraper, flat	25 cm handled	2 Nos.
48.	Scraper half round	25cm	2 Nos.
49.	Scraper triangular	25cm	2 Nos.
50.	Micrometer outside	0 to 150mm	1 set
51.	Micrometer (Inside)	25mm to 150mm	1 set
52.	Vernier caliper Depth to read both inches and	set 25 or 20 cm inside outside in mm	1 Nos.
53.	Hammer planishing		2 Nos.
54.	Setting hammer		2 Nos.
55.	Mallet (Wooden)		2 Nos.
56.	Trammel	30 cm	1 No.
57.	Blow lamp	0.5 litre	2 Nos.
58.	Soldering iron	120 watts	2 Nos.
59.	Soldering iron, copper	225 gms (Fire heated)	2 Nos.
60.	Pliers nose (round and straight)		2 each
61.	Snip straight		1 No.
62.	Pot melting		2 Nos.
63.	Poker		2 Nos.
64.	Open Spanners,	double ended set of 12 metric size 8 to 32	5sets

65.	Spanners, double off-set double	set of 7 W/W from 3 mm to 13.5 mm	5sets
66.	Double open ended ignition spanner of B.A.	Ox 1 to 8x9 set of 5 Spanner, Clyburn 15cm	1 set
67.	Adjustable Spanner	6inch, 12inch &18 inches	1 each
68.	Box spanner	set upto 32 mm	1 set
69.	Spanners ring of set of	6 S.I.	1 set
70.	Spanner for sparking plug		1 set
71.	Pipe Ranches Stilson type	6,12, 18 inches	2 each
72.	Set of Allen Key	1 mm to 12 mm by 1mm	2 set
73.	Double open ended spanner American	A/F size from 7.5 mm x 99 mm to 19 mm x 20.5 mm set of 6	1 No.
74.	Torque Wrench		1 No.
75.	Drill Drift	10mm x 150mm	2 Nos.
76.	Grease Gun		2 Nos.
77.	Oil Can	0.5 liter	2 Nos.
78.	Chain block	1 ton capacity	1 No.
79.	Tray cleaning	45 x 30 cm	1 No.
80.	Drilling machine pillar type capacity upto 20mm dia with motor		1 No.
81.	Valve Grinding Stick (consumable)		7 Nos.
82.	Valve seat cutting tools complete with guide & pilot bar (all angle) in a box		1 set
83.	Extractor stud "ezy out" Type		1 set
84.	Compression gauge		1 No.
85.	Oil Stone (consumable)		2 Nos.

86.	Piston Ring Remover and compressing tool		1 set each
87.	Fire extinguisher	Arrange all proper NOCs and equipment from municipal / competent authorities.	As per requirement
88.	Tachometer (counting type)		1 No.
89.	Puller set	6 inch & 12 inch	1 set
90.	Lifting jack mechanical	3 ton	2 Nos.
91.	Injection testing set (Hand operated)		1 No.
92.	Injection cleaning kit		2 sets
93.	Tube Expander with cutter (for copper tubes)s		1 Set
C. GENERAL MACHINERY			
94.	Bench Grinder	with two 17.5 cm wheels	1 No.
95.	Arbor press hand operated	2 ton capacity	1 No.
96.	Diesel engine cut away model two show working parts for demonstration	(One 2 stroke & one 4 stroke)	1 No.
97.	Diesel engine 4 stroke Multi cylinder	4/6 vehicular type Indian Make contemporary model	1 No.
98.	Petrol engine (Running condition, car type) Indian make		1 No.
99.	Diesel engine (Running condition) Stationary type		1 No.
100.	Petrol engine vertical (2 stroke)		1 No.
101.	Portable Hand Blower Electrically Operated		1 No.
102.	Battery charger		1 No.
103.	Hydrometer (consumable tool)		1 No.

D. WORKSHOP FURNITURE			
104.	Work bench	250x120x75 with four vices of 12.5 cm	5 Nos.
105.	Locker	with 8 drawers (standard size)	2 Nos.
106.	Metal Rack	180x150x45cm	2 Nos.
107.	Steel almirah / cupboard		1 No.
108.	Black board and easel		1 No.
109.	Instructor's Desk or table		1 No.
110.	Chair		1 No.

Note: -

1. *All the tools and equipment are to be procured as per BIS specification.*

ABBREVIATIONS

CTS	Craftsmen Training Scheme
ATS	Apprenticeship Training Scheme
CITS	Craft Instructor Training Scheme
DGT	Directorate General of Training
MSDE	Ministry of Skill Development and Entrepreneurship
NTC	National Trade Certificate
NAC	National Apprenticeship Certificate
NCIC	National Craft Instructor Certificate
LD	Locomotor Disability
CP	Cerebral Palsy
MD	Multiple Disabilities
LV	Low Vision
HH	Hard of Hearing
ID	Intellectual Disabilities
LC	Leprosy Cured
SLD	Specific Learning Disabilities
DW	Dwarfism
MI	Mental Illness
AA	Acid Attack
PwD	Person with disabilities


कौशलं बलम्